Quench Analysis Summaries for production LHC IR Quadrupoles LQXB01-08 / MQXB01-17

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Summary:

Training quenches of the first 17 cold masses have been studied systematically and are reported on here, to document the characteristics of all "nominal condition" training quenches. These studies focused on obtaining information from the quench antenna signals, and attempted to connect to information obtained from production voltage taps (in most cases, quarter coil "quadrant" voltage taps, each of which includes an inner and outer coil). They were necessitated by the limited performance of two separate cold masses, mqxb04 and mqxb14, which exhibited similar non-training character with remarkable reproducibility of their quench currents, location, and development, well below the target operating gradient in superfluid. Extensive ramp rate and temperature studies were conducted on these magnets, and some good cold masses were tested under similar temperature and ramp-rate conditions, so some of those data have also been summarized here. A "standard" summary form was devised and each quench was analyzed to extract the same set of details. These summaries form much of the basis for an MT-19 publication (FNAL pre-print FERMILAB-CONF-05-403, http://lss.fnal.gov/archive/2005/conf/fermilab-conf-05-403-td.pdf) which summarized the understanding of quench development in this series of magnet production tests, as of September 2005.

Since this conference publication, three additional LQXB assemblies were tested: LQXB06 was retested after Q2A heater repair, LQXB10 (mqxb18, mqxb19), and LQXB07 (mqxb15, mqxb14-1 rebuilt cold mass, with quadrant 2 coils replaced). Similar summaries of quenches from those tests have not yet been completed, and clearly this is now a priority since mqxb14-1 is also a limited magnet, with nearly identical behavior to mqxb14-0, but with the quenching coil moved to quadrant 3. One tentative conclusion of the above publication, that warm bore vibrations cause the self-triggered quench antenna noise events, was confirmed by experiment on LQXB06 (see MTF elog entry 3116, http://mtfpc49.fnal.gov/elog/controller/Entry?id=3116 for details).

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The Summaries:

Assembly	Location	Cold Mass (link to pdf summary report)
LQXB01	Q2B	MQXB01
	Q2A	MQXB02
LQXB02	Q2B	MQXB03
	Q2A	MQXB04
LQXB03	Q2B	MQXB05
	Q2A	MQXB06
LQXB04	Q2B	MQXB12
	Q2A	MQXB10
LQXB05	Q2B	MQXB08
	Q2A	MQXB11

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The Summaries, continued

Assembly	Location	Cold Mass (link to pdf summary report)
LQXB06	Q2B	MQXB09
	Q2A	MQXB07
LQXB07	Q2B	MQXB15
	Q2A	MQXB14
LQXB08	Q2B	MQXB03
	Q2A	MQXB13
LQXB09	Q2B	MQXB16
	Q2A	MQXB17